This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-6 + 10i)(5 + 8i)$$

The solution is $-110 + 2i$, which is option B.

A. $a \in [-31, -24]$ and $b \in [77, 82]$

$-30 + 80i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

B. $a \in [-113, -107]$ and $b \in [1, 8]$

* $-110 + 2i$, which is the correct option.

C. $a \in [45, 54]$ and $b \in [93, 99]$

$50 + 98i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-113, -107]$ and $b \in [-6, 1]$

$-110 - 2i$, which corresponds to adding a minus sign in both terms.

E. $a \in [45, 54]$ and $b \in [-98, -93]$

$50 - 98i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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2. Simplify the expression below and choose the interval the simplification is contained within.

$$20 - 3^2 + 14 \div 9 * 10 \div 17$$

The solution is 11.915, which is option C.

A. $[29.61, 30.26]$

29.915, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[28.47, 29.04]$

29.009, which corresponds to two Order of Operations errors.

C. $[11.8, 12.05]$

* 11.915, this is the correct option

D. $[10.14, 11.46]$

11.009, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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3. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{-11}{0} + \sqrt{221}i$$

The solution is Not a Complex Number, which is option D.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Not a Complex Number

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{33856}{529}}$$

The solution is Whole, which is option A.

A. Whole

* This is the correct option!

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Irrational

These cannot be written as a fraction of Integers.

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 184.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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5. Simplify the expression below and choose the interval the simplification is contained within.

$$16 - 6 \div 3 * 10 - (5 * 14)$$

The solution is -74.000, which is option B.

A. $[-55.2, -51.2]$

-54.200, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[-79, -73]$

* -74.000, which is the correct option.

C. $[83.8, 88.8]$

85.800, which corresponds to not distributing addition and subtraction correctly.

D. $[-135, -117]$

-126.000, which corresponds to not distributing a negative correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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6. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{-1950}{15}}$$

The solution is Not a Real number, which is option E.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

E. Not a Real number

* This is the correct option!

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $\sqrt{130}i$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 33i}{-2 - 4i}$$

The solution is $-13.80 + 11.10i$, which is option B.

A. $a \in [-1.5, 1]$ and $b \in [-19, -16.5]$

$-0.60 - 17.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-14.5, -13]$ and $b \in [10, 12]$

* $-13.80 + 11.10i$, which is the correct option.

C. $a \in [-14.5, -13]$ and $b \in [221.5, 223]$

$-13.80 + 222.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

D. $a \in [-277.5, -275.5]$ and $b \in [10, 12]$

$-276.00 + 11.10i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [-37, -35]$ and $b \in [-9, -7.5]$

$-36.00 - 8.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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8. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 - 66i}{3 - i}$$

The solution is $-6.90 - 24.30i$, which is option D.

A. $a \in [-17, -14.5]$ and $b \in [64.5, 66.5]$

$-15.00 + 66.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [-20.5, -19]$ and $b \in [-17, -14]$

$-20.10 - 15.30i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-69.5, -68.5]$ and $b \in [-24.5, -23]$

$-69.00 - 24.30i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-8.5, -5.5]$ and $b \in [-24.5, -23]$

* $-6.90 - 24.30i$, which is the correct option.

E. $a \in [-8.5, -5.5]$ and $b \in [-244, -242.5]$

$-6.90 - 243.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-5 - 9i)(-7 - 10i)$$

The solution is $-55 + 113i$, which is option B.

A. $a \in [117, 133]$ and $b \in [-18, -10]$

$125 - 13i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-55, -54]$ and $b \in [107, 117]$

* $-55 + 113i$, which is the correct option.

C. $a \in [-55, -54]$ and $b \in [-115, -107]$

$-55 - 113i$, which corresponds to adding a minus sign in both terms.

D. $a \in [33, 41]$ and $b \in [84, 91]$

$35 + 90i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [117, 133]$ and $b \in [12, 16]$

$125 + 13i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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10. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1664}{8}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option D.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Pure Imaginary

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.
